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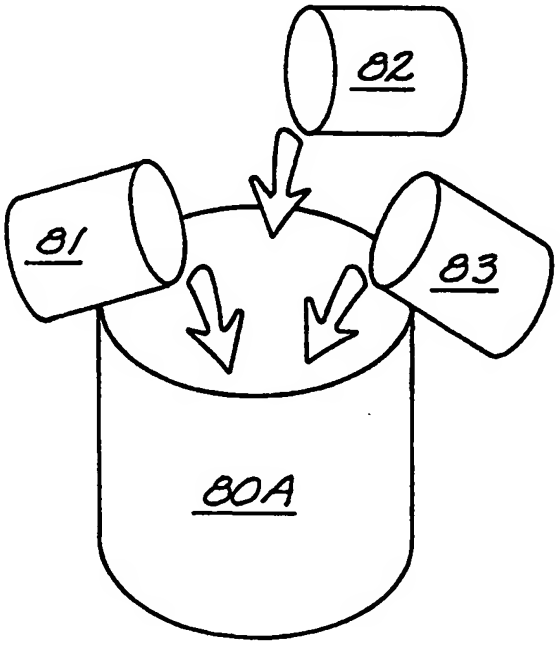
(54) Title: HUMAN DIET SUPPLEMENT

(57) Abstract

An enhanced food for humans which has significantly higher omega–3 content through the use of oil (82) from the salvia hispanica seed. The enhanced omega–3 content for the food is obtained by mixing oil (82) (whether the oil is extracted from the salvia hispanica seed or the seed is used whole) with a consumable carrier (81). In one embodiment of the invention, the salvia hispanica seed is ground into flour which is blended with traditional grain based flour for the preparation of cookies, breads, nutrition bars, crackers, and the like. In other embodiments, the salvia hispanica oil (82) is mixed with a liquid (83) (i.e. hot sauce, soft drinks, milk) which is then used either alone or in conjunction with other foods. In yet another embodiment, the consumable product (i.e. oatmeal) is used to absorb the salvia hispanica oil (82). The salvia hispanica oil is also useful in conjunction with a sweetener (whether natural occurring such as sugar or honey; as well as artifical sweeteners such as saccharin) allowing the invention to be added to drinks and foods just prior to consumption.



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HUMAN DIET SUPPLEMENT

Background of the Invention:

This invention relates generally to nourishment and more particularly to a reduction in human cholesterol and/or Triglycerides to improve health.

In 1995, 15 million people died from coronary heart disease (CHD). Cardiovascular diseases are related to nourishment, and are a particular concern in developed countries.

There is a growing consensus among scientists that reducing calories from lipid sources is important in controlling CHD. In addition, there is increasing evidence that omega-3 (ω-3) polyunsaturated fatty acids (PUFAs) such as alpha-linolenic (α-linolenic) fatty acid play a key role in the process. As an example, increased ω-3 polyunsaturated fatty acid consumption has been shown to reduce CHD.

The egg industry has been adversely affected by the undesirable relationship between cholesterol and saturated fatty acids in the diet, and CHD. This is evidenced by the rapidly declining per capita consumption of eggs over the past three decades, and is the major challenge facing the egg industry.

Research has shown that the lipid composition of egg yolks is influenced by the hens' dietary fat content. One method for producing omega-3 α-linolenic enriched eggs is by including ground flax seed in hens' diet. Consumption of these α-linolenic enriched eggs for one or two weeks results in a marked decline in serum triglycerides in humans. The problem with these α-linolenic enriched eggs, however, is an unpleasant fish-related flavor which is a significant market disadvantage.

It is clear that there is a need for a more acceptable method of increasing omega-3 fatty acids in eggs and other foods consumed by humans.

Summary of the Invention:

The invention creates healthier chicken products for human consumption in which the chicken product (meat or eggs) have increased omega-3 polyunsaturated fatty acid content and decreased saturated fatty acid content.

As noted above, the omega-3 content of meat and eggs from chickens is related to the chicken's feed; in the same manner, the flavor of the chicken's meat and eggs are also influenced by the feed provided the chicken.

This invention provides for chicken products which have increased omega-3 polyunsaturated fatty acid content and decreased saturated fatty acid content and which also have an agreeable flavor.

Within the invention, to increase the omega-3 content, the diet of the chicken is omega-3 enhanced through the use of seeds from the salvia hispanica. The salvia hispanica seed (commonly known as "chia") has been commercially grown in Central America for centuries.

The chia seeds are added to a traditional grain based chicken feed to increase the omega-3 content of the overall feed. In the preferred embodiment, the chia constitutes at least seven percent (7%) by weight of the mixture.

By increasing the percentage of the mixture which is chia, the level of omega-3 is also increased, and by extension, the chicken products also have increased omega-3 contents.

In this manner, it is possible to produce varying levels of omega-3 chicken products for the consumer. As an example, the consumer is able to choose eggs which have "X" levels of omega-3; or alternatively a higher "Y" level if the consumer needs that level to treat their cholesterol level and/or Triglycerides.

To obtain this layered marketing potential, selected groups of chickens are fed the chia/grain based mixture in which the chia constitutes a percentage of the mixture. In this context, a standard egg producing chicken is fed a 0% mixture while an "enhanced" egg producing chicken is fed a 20% mixture. The "enhanced" egg is then packaged with an identifier that shows the omega-3 content of the egg.

In some embodiments, the seeds are applied whole to the grain based chicken feed; in other embodiments, the seeds are cracked or crushed to release the seed's omega-3 rich oil. The crushing or cracking of the chia seed is accomplished using any of the traditional

methods well known to those of ordinary skill in the art.

When crushed or cracked, the chia seed releases its omega-3 oil which is absorbed by the surrounding grain based feed.

The proportion of salvia hispanica seed mixed into the grain based chicken feed is preferably at least 7%; but, the ratio is adjusted in reliance to testing of the chicken product so that the targeted omega-3 polyunsaturated fatty acid content is achieved.

No upper limit on the chia percentage of the mixture has been experienced, except that the mixture ideally contains all of the minerals and vitamins that are required to maintain the chicken in a healthy state.

More particularly, the present invention creates a food product having a higher omega-3 content and lower saturated fatty acid content. This is accomplished using seeds from the chia or salvia hispanica L. plant.

Chia (Salvia hispanica L.) is a summer annual belonging to the Labiate family. It originated in mountainous regions extending from west central Mexico, to northern Guatemala. Chia seed, which is rich in ω-3 α-linolenic fatty acid (62%), contains about 33% oil and has a long history of use in pre-columbian diets. Natural antioxidants in the seed protect the ω-3 α-linolenic fatty acid from degrading, unless the oil is extracted. As a consequence, the seeds are a very good, stable source of ω-3 PUFA.

An example of chia's potential has been demonstrated in a variety of tests. In one such test, twenty four Issa Brown laying hens were fed four weeks for the purpose of comparing a control diet to a diet containing 30 percent whole chia (Salvia hispanica L.) seeds. The egg weight and production, cholesterol content, total fat content, and fatty acid composition of the yolks were determined weekly.

No statistically significant difference ($P<0.05$) in yolk fat content was found between treatments. Saturated palmitic fatty acid content of yolks was significantly ($P<0.05$) less with the chia diet, with a 35 percent difference found at the end of the trial. Polyunsaturated, ω-3 α-linolenic fatty acid was significantly greater ($P<0.05$) in yolks from the chia diet, and increased from 0 to 14.7 percent by the end of the trial.

This test clearly established that the chia augmented chicken feed had the desired affect, increasing the omega-3 content of the eggs and decreasing the saturated fatty acid content.

The salvia hispanica's omega-3 capabilities are also capitalized by this invention when used as an additive for human consumption. Human food of this invention has significantly higher omega-3 content through the use of oil from the salvia hispanica seed.

The enhanced omega-3 content for the food is obtained by mixing oil (whether the oil is extracted from the salvia hispanica seed or the seed is used whole) with a consumable carrier. In this context, the "consumable carrier" is practically unlimited as a food group. Both beverages and solid food is considered within this category.

In one embodiment of the invention, the salvia hispanica seed is ground into flour which is blended with traditional grain based flour for the preparation of cookies, breads, nutrition bars, crackers, and the like. As flour, the oil is communicated into the baked goods.

These baked goods include a wide range of items such as snacking crackers. Flavoring (i.e. spices, seasoning, and coatings) the crackers improve the flavor of the crackers. In this manner, as the consumer eats the snack, they are actually improving their health.

As example, when the salvia hispanica oil via flour is blended into a potato-chip like batter, the resulting potato-chip exhibits positive medical affects instead of the negative medical affects that potato-chips normally produce.

Another application of the salvia hispanica flour is used in a nutritional bar in which a fruit flavoring is contained within the bar. Another nutritional bar using the salvia hispanica flour applies a coating around the bar to increase the palatability of the nutritional bar. Some such coatings include, but are not limited to: chocolate, cocoa, fudge, and nuts.

In other embodiments, the salvia hispanica oil is extracted from the seed and the oil is mixed with a liquid (i.e. hot sauce, soft drinks, milk). Ideally, the oil and carrier liquid are emulsified so that the two components do not separate.

The enhanced liquid combination is then either consumed alone (in the case of a soft drink) or is used as a flavoring with other foods (i.e. tacos with the "enhanced" hot sauce or cereal with "enhanced" milk).

In yet another embodiment, the consumable product (i.e. oatmeal) absorbs the salvia hispanica oil. Oatmeal has been shown to assist in the reduction of cholesterol problems, with the inclusion of the omega-3 rich oil from the salvia hispanica seed, the "enhanced"

oatmeal is extremely beneficial. The salvia hispanica oil is sprayed onto the oatmeal (which readily absorbs the oil) just prior to packaging.

The salvia hispanica oil is also useful in conjunction with a sweetener (whether naturally occurring such as sugar or honey; as well as artificial sweeteners such as sacarin) allowing the invention to be added to drinks and foods just prior to consumption. Often this enhanced sweetener is packaged in individual packets allowing the user to take their own enhanced sweetener to restaurants and on trips.

In all of the human food embodiments above, the oil/flour of the salvia hispanica is extremely palatable as no negitive taste or odor is associated with the oil/flour. This attribute of the salvia hispanica stands in stark contrast to other sources of omega-3 such as fish oil products.

In still another embodiment, the salvia hispanica oil is combined with a carrier or thickening agent and is placed within a swallowable caplett/capsule. In this configuration, the combination is simply swallowed to provide the omega-3 qualities sought.

The caplett embodiment is further enhanced with the inclusion of heart related drugs such as aspirin.

The invention, together with various embodiments thereof, will be more fully explained by the accompanying drawings and the following descriptions.

Drawings in Brief:

Figure 1 graphically illustrates the creation of an embodiment of the feed of this invention which is packaged and then shipped to the chicken farm.

Figure 2 graphically illustrates the in-situ creation of the chicken feed of this invention.

Figure 3, a table, illustrates a test diet differed from the control and containing 30% whole chia seed.

Figure 4, a table, studies the saturated palmitic fatty acid levels.

Figure 5, a table, compares eggs from the control and chia diets.

Figure 6 illustrates the use of two feeds having differing concentrations to produce multiple layers of omega-3 chicken products.

Figures 7A, 7B, and 7C illustrate embodiments of the invention created by flour from

the salvia hispanica seed.

Figures 8A and 8B illustrate the creation of a liquid using the salvia hispanica oil.

Figures 9A and 9B illustrate the application of the liquid from figures 8A and 8B into differing containers.

Figure 10A and 10B illustrate the use of salvia hispanica oil in conjunction with a sweetener.

Figures 11A and 11B graphically illustrate the application of salvia hispanica oil onto oatmeal and snack foods.

Figure 12 shows an embodiment of the invention which has been encapsulated for human consumption.

Drawings in Detail:

Figure 1 graphically illustrates the creation of an embodiment of the feed of this invention which is packaged and then shipped to the chicken farm.

In this embodiment, the mixing activity is conducted within hopper 12. Grain based feed 10 is deposited into hopper 12 together with chia seeds 12. The two are then blended using auger 13 which mixes the contents of hopper 12.

Once fully mixed, the mixture is bagged 14 and then transported 15 to the chicken farm where the mixture is used.

In an alternative embodiment of the invention, the chia seed 11 is passed through crusher 16 which either cracks or crushes the chia seeds so that the omega-3 rich oil is able to mix more easily with the grain based feed. In an alternative embodiment, the chia seed oil is extracted and then mixed with the grain based feed to provide the omega-3 enrichment,

Figure 2 graphically illustrates the in-situ creation of the chicken feed of this invention.

Feed loop 23 uses a continuous chain which is drug through a pipe by motor 22. As the chain moves by gears 21, a predefined amount of chia seed is deposited into the feed loop 23A from hopper 20A.

The chia seed within feed loop 23A then passes beneath grain feed hopper 20B where the feed loop 23A is filled to capacity. During the transit of the chain, the chia and the grain feed mix.

Eventually the mixture is deposited from the feed loop 23B into feeder 24 where

chicken 25 has access to the omega-3 enriched mixture.

The chain continues on to other chickens (not shown) and eventually returns to motor 22 to repeat the operation.

In this manner, the chickens are provided ample feed which is omega-3 enriched.

Figure 3, a table, illustrates a test diet different from the control and containing 30% whole chia seed.

For the experiment, the diets of which are illustrated in figure 3, the feeding period lasted four weeks, with each hen receiving 135 gm of feed/day. All of the hens were weighed individually at the start, and at the end of the trial. Eggs were collected daily, counted and weighed.

Two eggs from each treatment, each day, were randomly selected and placed in storage at 4^0 C. The remaining eggs were placed in unrefrigerated storage, as is commercial practice in the region.

To determine yolk and white weights, forty non-refrigerated eggs, twenty from each treatment, were selected at random from the fourth week's production. Each egg was weighed, broken open, the yolk separated from white, and then the yolk and white were weighed separately.

A taste test was conducted to evaluate palatability, and to determine if off-flavors were present. This test used eggs collected during the last week of the trial, with the eggs stored in an unrefrigerated room for 10 days prior to evaluation.

All of the eggs were prepared in the same manner, two hours before the taste test. Eggs from each treatment were placed in cold water, brought to boiling, then taken from the pot and let cool at room temperature in a large dish. The eggs were then hand shelled, and placed in two containers.

Sixteen untrained adult panelists (6 females and 10 males), having two different levels of income (high and low), were chosen for the trial. Each panelist received two eggs, one randomly selected from each container.

Panelist preferences were scored using the following scale: 1 represented a preference of one egg over the other, and 0 represented no difference between eggs. Flavor was scored as: 3 strong off-flavor, 2 mild off-flavor, and 1 no off-flavor.

In accommodating the inexperienced panelists the test experienced some scientific

limitations. First, panelists had a choice of bottled water, a soft drink or red wine to drink with the eggs. Secondly, salt was made available to them.

Two of the six eggs which had been refrigerated during the last three days of each week, from each treatment, were randomly selected for measurement of cholesterol, total fat content and fatty acid composition. The eggs were weighed, broken open, and the yolk separated from the white by the laboratories contracted to do the analyses.

Lipids were extracted from each yolk following established techniques.

The feeding trial was set up as a randomized block design, with the experimental unit being one cage of three hens. A treatment was comprised of 12 adjacently caged hens. The egg analyses were replicated, to permit statistical analysis of the data.

Each variable was compared using the Generalized Linear Model analysis of variance technique to assess treatment differences. When the F-value was significant ($P<0.05$), differences in means were analyzed for significance using Duncan's Multiple Range Test.

Figure 4, a table, presents the yolk fatty acid levels.

As shown, the table is divided into two sections to facilitate presentation, although the data are repeated. The top of the table presents a comparison within treatments, while the bottom presents a comparison between treatments.

Only those fatty acids found in amounts greater than a trace are included in this table. The ratio ω-3:ω-6 is reversed compared to that which is normally reported. This was done since an ω-3 value of 0 in the denominator yields a value of infinity. This cannot be statistically analyzed.

Stearic acid increased for both treatments over the course of the trial, however the change was statistically significant ($P<0.05$) only for the control diet. Mono-unsaturated oleic fatty acid content decreased significantly ($P<0.05$) for both treatments, at the end of the trial.

Saturated palmitic fatty acid levels were significantly ($P<0.05$) lower with the chia diet, than the control diet, from the second week onward. At the end of the trial the difference amounted to 35 percent.

Polyunsaturated, ω-3 α-linolenic fatty acid was significantly greater ($P<0.05$) in eggs produced by hens fed the 30 percent chia diet, than those fed the control diet. This was true each week, except the first. By the end of the trial α-linolenic acid content was 14.7 percent.

Addition of chia to the hens' diet resulted in the SFA:PUFA ratio being statistically different ($P<0.05$) between treatments for the second and third weeks of the trial. SFA content was calculated as the sum of palmitic and stearic fatty acids, and PUFA content was calculated as the sum of the linoleic and linolenic fatty acids.

Chia in the hens' diet also resulted in a statistically significant ($P<0.05$) difference in the ω-3:ω-6 ratio between treatments throughout the trial. The chia diet consistently gave a better ratio, than did the control diet. Chia improved the saturated to polyunsaturated fatty acid ratio in the yolks, compared to the control diet.

Figure 5, a table, compares egg taste and flavor from the control and chia diets.

In this table, eggs from the control and chia diets demonstrated no statistically significant differences ($P<0.05$) in taste preference, or intensity of off-flavor. On average, the chia fed hens produced eggs with a milder flavor, than did the hens fed the control diet.

No statistically significant difference ($P<0.05$)in egg taste or off-flavor was found between treatments.

The significant difference found between treatments in cholesterol content during the second week is credited with dietary energy levels. Diet has been shown to modify yolk cholesterol and fatty acid concentrations, with the major route of cholesterol excretion in hens being through their eggs.

Because the chia seed simply replaced portions of the control diet on a weight basis, the oil content changed from 6.67 percent, to approximately 14.5 percent. The increased cholesterol content found in the egg yolks produced by the chia-fed hens came from the change in energy. By properly balancing the energy levels of the diets, this potentially negative effect can be avoided.

Perhaps the most significant finding in the chia trial was the effect the chia had on the saturated palmitic, and the polyunsaturated ω-3 fatty acid contents of the yolks. The chia study suggests that hens are able to alter the saturated fatty acid composition of egg yolk. A high dietary intake of PUFA, such as in the chia trial, reduces synthesis of saturated fatty acids.

Chia improved the relationship between yolk SFAs and PUFAs, and brought it more in line with the 1:1 ratio recommended by the American Heart Association, and the Canadian Department of Health and Welfare. The change in the ratio found in the chia trial was

surprisingly higher than that obtained in the traditional approach of adding 17 percent flax seed, or four percent fish oil to hens' diets.

The ω-3:ω-6 ratio produced by the chia diet also produced unexpected results by exceeding the recommendations made by FAO of 0.1 to 0.2, and by the British Nutrition Foundation of 0.2. Thus, adding chia to hens' diet significantly improves the egg's nutritional quality.

These tables clearly show that changes in fatty acid composition of egg yolks were brought about by feeding chia to hens. Saturated fatty acid content was reduced, ω-3 polyunsaturated fatty acid content was increased, SFA:PUFA and ω-3:ω-6 ratios were improved, and off-flavors were absent. These factors would make eggs and egg products more acceptable to health-conscious consumers, and could reverse the declining per capita consumption of eggs and egg products occurring in recent years.

While the above fully illustrates the capability of the chia to improve egg characteristics, the present invention also contemplates the use of chia seed for a variety of other applications, including, but not limited to:

- use of chia in chicken feed to increase omega-3 fatty acids and decrease saturated fatty acids within chicken eggs and meat;
- use of chia in cattle feed to increase omega-3 fatty acids and decrease saturated fatty acids within milk, milk products, and meat;
- use of chia in pig feed to increase omega-3 and fatty acids and decrease saturated fatty acids within pork and port products;
- use of eggs from hens fed chia enriched diets to lower serum cholesterol and triglyceride levels in humans;
- use of whole chia seeds to lower the serum cholesterol and triglycerides in humans;
- use of chia oil to lower the serum cholesterol and triglycerides in humans.

Figure 6 illustrates the use of two feeds having differing concentrations to produce multiple layers of omega-3 chicken products.

While the present illustration shows two different levels, those of ordinary skill in the art readily recognize that using the techniques explained herein, a continuous spectrum of omega-3 content is available.

The steps required for this process, are

1) prepare a first and a second mixture (12A and 12B); while each mixture contains grain based chicken feed, there is a higher percentage of seeds of the salvia hispanica (chia) in the second mixture than the first;

2) for each product line or group of chickens, they are fed their respective mixture (70A, 70B), the product (eggs in this illustration) are collected (71A, 71B), tests (72A, 72B) are conducted to identifying the omega-3 level of the product, and, the eggs are packaged in cartons having labels identifying the omega-3 level or range.

Through this technique, the consumer is provided with a product (eggs in this illustration, chicken meat is not shown) which meets the consumers needs/wants for an omega-3 level.

Figures 7A, 7B, and 7C illustrate embodiments of the invention created by flour from the salvia hispanica seed.

The salvia hispanica's omega-3 capabilities are also capitalized in this invention when used as an additive for human consumption. As such, human food has significantly higher omega-3 content through the use of oil from the salvia hispanica seed. In this illustration, the salvia hispanica oil is contained within the flour from the seed which is used in the baking process.

Prior to baking, the salvia hispanica seed is ground into flour which is then blended with traditional grain based flour for the preparation of cookies, breads, nutrition bars, crackers, and the like. As a flour, the oil is communicated into the baked goods.

Referring to figure 7A, snack bar 70A is made having an outer shell created with grain based flour as well as salvia hispanica flour. In this embodiment, the core of snack bar 70A is a fruit filling 71.

Also, in this embodiment of snack bar 70A, an outer coating 72, made from cocoa is applied to further increase the flavor of snack bar 70A. Cocoa is chosen as it is fat free. Other coatings suitable for this application are: chocolate, fudge, and nuts.

In figure 7B, snack bar 70B is also baked using flour from both grains and salvia hispanica seed, thereby forming the core 73B. Attached to the outer surface of core 73B are salvia hispanica seeds 74 which have been sprinkled onto core 73B.

Whether it is the snack bar 70A or the snack bar 70B, one embodiment of the

invention individually packages the snack bar (as shown in figure 7C) within a tearable package 75. In this way, the consumer is able to take a single snack bar to a picnic or work-out.

Flavoring the baked goods improve their flavor; although there are no unpleasant taste or flavor associated with the salvia hispanica.

Figures 8A and 8B illustrate the creation of a liquid using the salvia hispanica oil.

The salvia hispanica oil is extracted from the seed and the oil 82 is mixed (represented by bowl 80A) with a liquid carrier 81. In some embodiments of this application, the mixture of oil/liquid has flavoring 83 mixed with it. Flavoring 83 allows the creation of a wide variety of mixtures from hot sauce to soft drinks.

In one application, no flavoring is used and the liquid carrier is a milk product. When skim or no-fat milk is used, this application permits the creation of a milk product which is extremely healthy with enhanced omega-3 qualities.

Once the chosen mixture has been created, it is mixed (represented by bowl 80B and mixer 84) shown in figure 8B. While some embodiments do not require more than a simple mixing of the components, often it is desirable to emulsify the oil into the carrier liquid so that separation does not occur.

Figures 9A and 9B illustrate the application of the liquid from figures 8A and 8B into differing containers.

The enhanced liquid combination (described in figures 8A and 8B) is either consumed alone (in the case of a soft drink) or is used as a flavoring with other foods (i.e. tacos with the "enhanced" hot sauce or cereal with "enhanced" milk).

As shown in figure 9A, the mixture described in figures 8A and 8B is dispensed 91A into a beverage can 90A and is then sealed.

Figure 9B illustrates dispensing 91B of the mixture into a shaker bottle 90B. This packaging of the mixture is ideal for such applications as hot sauce and cooking condiments.

Figure 10A and 10B illustrate the use of salvia hispanica oil in conjunction with a sweetener.

In this use of the salvia hispanica oil, the oil is dispensed 100 into a mixing container 101 containing a sweetener 103. The oil 100 and sweetener 103 is mixed 102 to a substantially uniform consistency. Individual portions of the mixture are then packaged 104

for use by the consumer. In individual packets, the healthy sweetener allows the user to take their own enhanced sweetener to restaurants and on trips.

In this context, sweetener 103 includes natural occurring sweeteners such as sugar or honey; as well as artificial sweeteners such as sacarin.

Figures 11A and 11B graphically illustrate the application of salvia hispanica oil onto oatmeal and snack foods.

Referring to figure 11A, cooked oatmeal 113 is pulled from oven 110 by conveyor 111. Oatmeal 113 is treated with salvia hispanica oil from sprayer 112. The oatmeal naturally absorbs the oil. The treated oatmeal is then packaged 114 for distribution to the consumer.

Oatmeal has been shown to assist in the reduction of cholesterol problems. With the inclusion of the omega-3 rich oil from the salvia hispanica seed, the "enhanced" oatmeal is extremely beneficial.

In figure 1B, the preparation and treating of snacks (from crackers to "potato chips") is shown. Dough dispenser 115 places dough 118A onto the conveyor which transports the dough through oven 116 where the dough is cooked, emerging as an untreated cracker 118B.

Sprayer 117 deposits a coating of salvia hispanica oil onto the untreated crackers 118B, creating a treated cracker 118C which is deposited into package 119.

If dough 118A is chosen from a "potato-chip" recipe, then the resulting potato-chip exhibits positive medical affects.

Figure 12 shows an embodiment of the invention which has been encapsulated for human consumption.

Patient 120 is provided a caplett 121 containing a carrier together with the oil from the salvia hispanica seed. Dispensed by health food stores and pharmacies, a package 122 of such capletts 121 allow the patient to improve their omega-3 content, and by extension, their health.

In some applications, the salvia hispanica oil is combined with a carrier or thickening agent and is placed within a swallowable caplett/capsule. The caplett/capsule embodiment is further enhanced with the inclusion of heart related drugs such as aspirin.

It is clear that the salvia hispanica oil is extremely versatile and beneficial for human consumption.

What is claimed is:

1. An omega-3 rich human food comprising:

a) a consumable carrier; and,

a) salvia hispanica oil mixed within said consumable carrier.

2. The omega-3 rich human food according to claim 1, wherein said salvia hispanica oil is contained within a salvia hispanica flour.

3. The omega-3 rich human food according to claim 2:

a) further including a grain based flour mixed with said salvia hispanica flour; and,

b) wherein said grain based flour and said salvia hispanica flour is baked as a unit in a pre-selected portion.

4. The omega-3 rich human food according to claim 3, further including a flavor coating on said pre-selected portion.

5. The omega-3 rich human food according to claim 4, further including fruit based filling contained with said portion.

6. The omega-3 rich human food according to claim 1,

a) wherein said consumable carrier is a liquid carrier; and,

b) wherein said oil from salvia hispanica is emulsified in said consumable carrier.

7. The omega-3 rich human food according to claim 6, wherein said salvia hispanica oil and said liquid carrier is contained in a single use package.

8. The omega-3 rich human food according to claim 7, further including flavoring.

9. The omega-3 rich human food according to claim 1, wherein said consumable carrier includes a sweetening agent.

10. The omega-3 rich food according to claim 1, wherein said consumable carrier includes processed oatmeal and wherein said salvia hispanica oil is encased said oatmeal.

11. The omega-3 food according to claim 1,

a) further including a dissolvable caplett suitable for swallowing by a human; and,

b) wherein a pre-determined volume of said consumable carrier and said salvia hispanica oil is contained within said dissolvable caplett.

12. The omega-3 food according to claim 11, further including a pharmaceutical drug contained within said dissolvable caplett.

13. A method of producing a chicken feed having increased omega-3 polyunsaturated fatty acid content comprising the steps of:

a) obtaining a grain based chicken feed; and,

b) mixing into said grain based chicken feed, seeds of salvia hispanica wherein said salvia hispanica constitute at least seven percent by weight of a resulting mixture.

14. The method of producing a chicken feed according to claim 13, further including the steps of:

a) establishing a content of omega-3 polyunsaturated fatty acid in eggs from chickens fed said mixture; and,

b) adjusting the percent by weight of said seeds of salvia hispanica in said mixture based upon the content of omega-3 polyunsaturated fatty acid in said eggs.

15. The method of producing a chicken feed according to claim 13, further including the steps of:

a) establishing content of omega-3 polyunsaturated fatty acid in meat of chickens fed said chicken feed; and,

b) adjusting the percent by weight of said seeds of salvia hispanica in said mixture based upon the content of omega-3 polyunsaturated fatty acid in said meat.

16. A feed mixture for chickens comprising:

a) a grain based chicken feed; and,

b) seeds of salvia hispanica wherein said salvia hispanica constitutes at least seven percent by weight of said feed mixture.

17. The feed mixture according to claim 16, wherein said seeds of salvia hispanica are partially crushed.

18. A method of producing chicken products comprising the steps of:

a) preparing a first and a second mixture,

1) wherein said first mixture includes a grain based chicken feed and seeds of salvia hispanica wherein said salvia hispanica constitute a first percentage of the first mixture, and,

2) wherein said second mixture includes a grain based chicken feed and seeds of salvia hispanica wherein said salvia hispanica constitute a second percentage of the second mixture, said first percentage being less than said second percentage;

b) for a first group of chickens,

1) feeding said first mixture to the first group of chickens,

2) obtaining a product from said first group of chickens,

3) identifying a first omega-3 level of said first product from said first group of chickens, and,

4) packaging said product from said first group of chickens with an indicia of said first omega-3 level;

b) for a second group of chickens,

1) feeding said second mixture to the second group of chickens,

2) obtaining a product from said second group of chickens,

3) identifying a second omega-3 level of said product from said second group of chickens, and,

4) packaging said product from said second group of chickens with an indicia of said second omega-3 level.

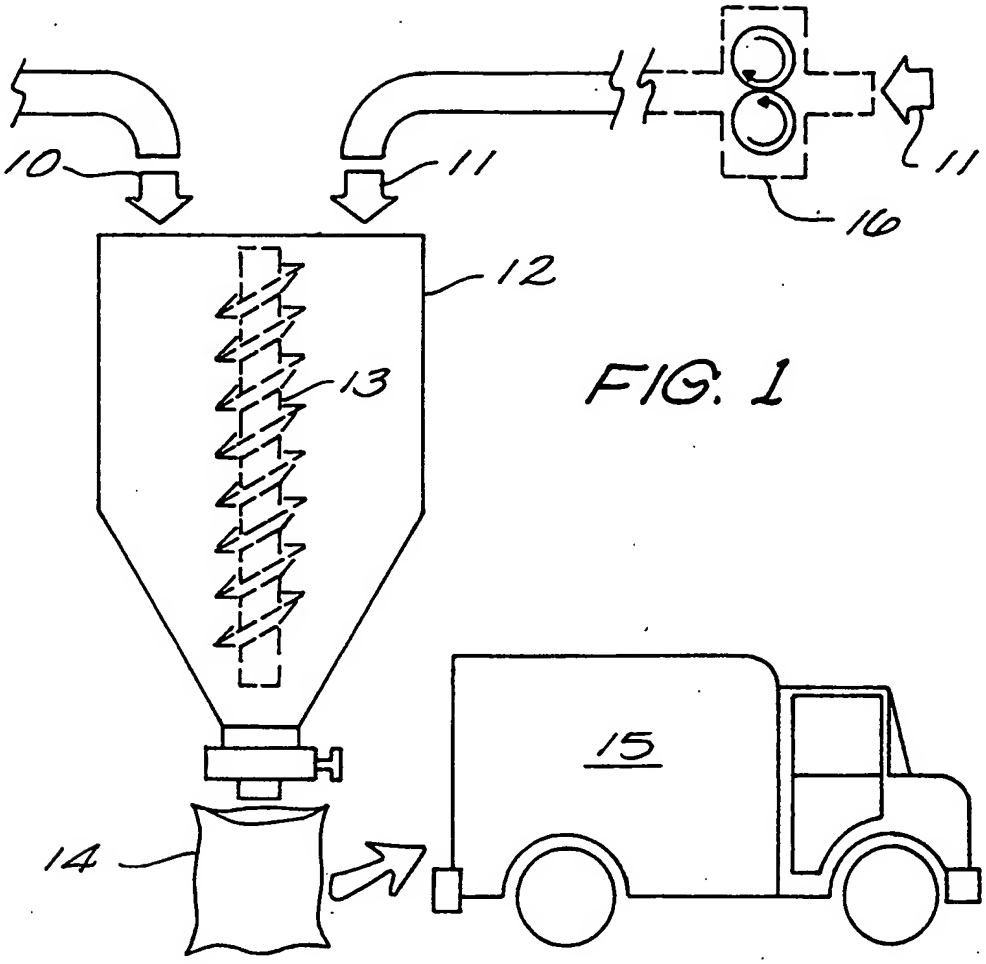

FIG. 1

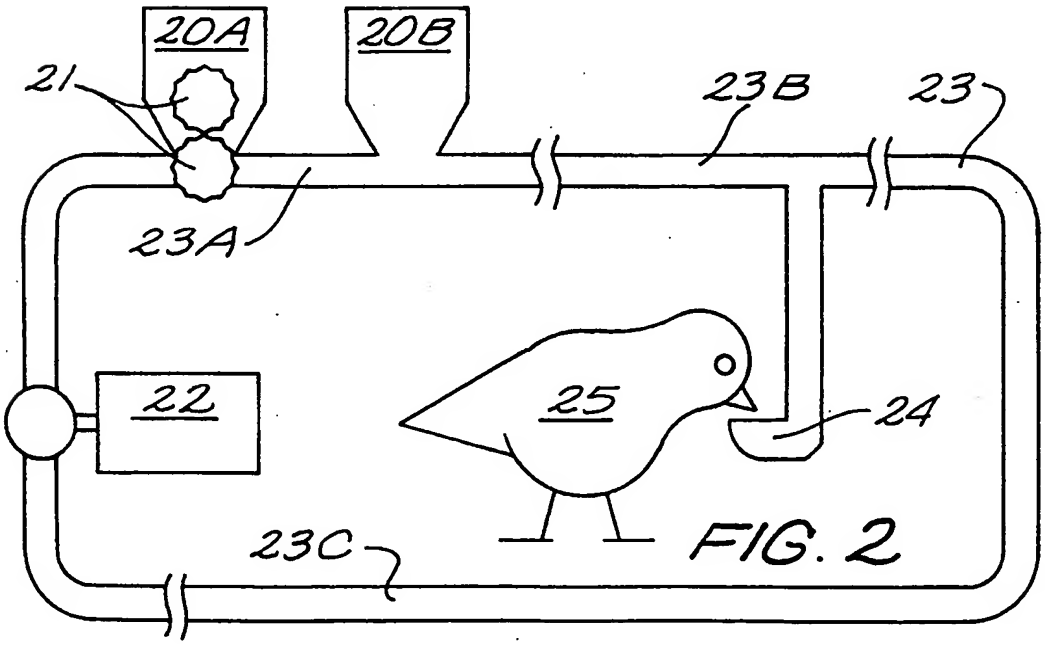

FIG. 2

OMEGA-3 ENRICHED CHIA DIET
EGG PRODUCTION, EGG WEIGHT, EGG YOLK

PARAMETER		EGG PROD. (EGGS/DAY/TREAT)	EGG WT. (GM.)	YOLK (GM.)
0% CHIA	1	11.28 bz	65.77 a	
	2	11.85 a	63.76 a	
	3	11.85 a	65.55 a	
	4	11.28 b	62.62 a	
		cr y: 0.52	cr: 4.96	
30% CHIA	1	10.14 a	63.70 a	
	2	10.71 a	63.68 a	
	3	10.57 a	66.04 a	
	4	10.00 a	64.98 a	
		cr: 1.95	cr: 5.20	
1ST. WK.	0% CHIA	11.28 a	65.77 a	
	30% CHIA	10.14 b	63.70 a	
		cr: 0.94	cr: 4.67	
2ND. WK.	0% CHIA	11.86 a	63.76 a	
	30% CHIA	10.71 b	63.68 a	
		cr: 1.12	cr: 4.70	
3RD. WK.	0% CHIA	11.85 a	65.55 a	
	30% CHIA	10.57 b	66.04 a	
		cr: 0.93	cr: 3.24	
4TH. WK.	0% CHIA	11.28 a	62.62 a	19.48 a
	30% CHIA	10.00 b	64.98 a	17.92 b
		cr: 0.80	cr: 3.08	cr: 0.78

z MEANS WITHIN A GROUPING LACKING A COMMON SUBSCRIPT DIFFER ($P < 0.05$) ACCORDING TO DUNCANS MULTIPLE RANGE TEST

y CRITICAL RANGE FOR MEAN SEPARATION

FIG. 3

FOR LAYING HENS
AND WHITE WEIGHT, AND HEN WEIGHT

WHITE WT. (%)	WHITE WT. (GM.)	HEN WEIGHT (KG.)	HEN WT. GAIN (GM.)
		1.96 [a]	
		1.87 [a]	
		cr: 0.04	
		1.85 [a]	
		1.83 [a]	
		cr: 0.02	
		1.96 [a]	
		1.85 [a]	
		cr: 0.14	
36 [a]	34.24 [a]	1.87 [a]	-0.09 [a]
34 [a]	33.54 [a]	1.83 [a]	-0.02 [a]
cr: 3.5	cr: 2.44	cr: 0.16	cr: 0.13

FIG. 3 CONTINUED

OMEGA-3 ENRICHED CHIA DIET
THE INFLUENCE OF DIETARY CHIA LEVEL FAT CONTENT AND CHOLESTEROL CONTENT

PARAMETER	FAT % [Z]	CHOLESTEROL %	PALMITIC %	PALMITOLEIC %
0% CHIA				
1 WEEK	9.65[aY]	0.38[a]	25.30[a]	2.38[a]
2 WEEK	9.15[a]	0.28[a]	24.59[a]	2.66[a]
3 WEEK	9.60[a]	0.28[a]	25.72[a]	2.45[a]
4 WEEK	9.10[a]	0.35[a]	28.35[a]	--
	cr[X]:1.90	cr:0.14	cr:4.05	cr:1.87
30% CHIA				
1 WEEK	9.95[a]	0.35[a]	20.47[a]	2.01[ab]
2 WEEK	9.70[a]	0.38[a]	18.31[a]	2.37[a]
3 WEEK	9.25[a]	0.28[a]	19.76[a]	0.46[c]
4 WEEK	10.30[a]	0.42[a]	18.32[a]	0.70[bc]
	cr:3.85	cr:0.15	cr:8.45	cr:1.53
1ST. WEEK				
0% CHIA	9.65[a]	0.38[a]	25.29[a]	2.38[a]
30% CHIA	9.95[a]	0.35[a]	20.47[a]	2.01[a]
	cr:1.95	cr:0.27	cr:12.05	cr:2.09
2ND. WEEK				
0% CHIA	9.12[a]	0.28[a]	24.59[a]	2.66[a]
30% CHIA	9.70[a]	0.38[a]	18.31[b]	1.89[a]
	cr:3.88	cr:0.09	cr:3.98	cr:2.05
3RD. WEEK				
0% CHIA	9.60[a]	0.28[a]	25.72[a]	2.45[a]
30% CHIA	9.25[a]	0.28[a]	19.75[b]	0.46[a]
	cr:5.24	cr:0.24	cr:1.90	cr:2.14
4TH. WEEK				
0% CHIA	9.10[a]	0.35[a]	28.35[a]	--
30% CHIA	10.30[a]	0.42[a]	18.32[b]	0.70[a]
	cr:8.80	cr:0.11	cr:8.85	cr:3.03

Z PERCENTAGE BASED ON TOTAL EGG WEIGHT
Y MEANS WITHIN A GROUPING LACKING A ACCORDING TO DUNCAN'S MULTIPLE RANGE
X CRITICAL RANGE FOR MEAN SEPARATION
W SFA ~ SATURATED FATTY ACID
V PUFA ~ POLY UNSATURATED FATTY ACID

FIG. 4

FOR LAYING HENS
ON FATTY ACID COMPOSITION,
OF EGGS

FATTY ACID STEARIC %	OLEIC %	LINO-LEIC %	LINO-LENIC %	SFA W: PUFA V RATIO	ω-3 : ω-6 RATIO
8.40^{b}	43.16^{a}	20.75^{a}	0.00^{b}	1.61^{ab}	0.00^{b}
8.49^{b}	42.40^{a}	21.86^{a}	0.00^{b}	1.52^{a}	0.00^{b}
9.21^{b}	39.58^{a}	21.72^{a}	1.14^{a}	1.52^{a}	0.05^{a}
13.30^{a}	31.05^{b}	21.00^{a}	0.00^{b}	1.96^{b}	0.00^{b}
cr:3.20	cr:5.08	cr:2.05	cr:0.03	cr:0.34	cr:0.001
9.88^{ab}	36.00^{a}	20.17^{a}	11.45^{a}	0.91^{a}	0.55^{a}
7.70^{b}	37.55^{a}	21.28^{a}	12.79^{a}	0.76^{a}	0.60^{a}
11.28^{ab}	34.24^{ab}	21.28^{a}	12.61^{a}	0.91^{a}	0.59^{a}
12.77^{a}	28.01^{b}	24.24^{a}	14.66^{a}	0.78^{a}	0.60^{a}
cr:4.66	cr:7.68	cr:7.07	cr:9.55	cr:2.04	cr:0.31
8.40^{a}	43.16^{a}	20.75^{a}	0.00^{a}	1.61^{a}	0.00^{b}
9.88^{a}	36.00^{a}	20.17^{a}	11.46^{a}	0.91^{a}	0.55^{a}
cr:5.46	cr:11.00	cr:10.37	cr:11.91	cr:1.41	cr:0.36
8.49^{a}	42.40^{a}	21.86^{a}	0.00^{b}	1.52^{a}	0.00^{b}
7.70^{a}	37.55^{a}	21.28^{a}	12.79^{a}	0.76^{b}	0.60^{a}
cr:4.20	cr:8.78	cr:2.73	cr:1.51	cr:0.14	cr:0.06
9.21^{a}	39.58^{a}	21.72^{a}	1.13^{b}	1.52^{a}	0.05^{b}
11.28^{a}	34.24^{a}	21.28^{a}	12.61^{a}	0.91^{b}	0.60^{a}
cr:5.78	cr:6.36	cr:1.99	cr:2.82	cr:0.26	cr:0.15
13.30^{a}	31.05^{a}	21.00^{b}	0.00^{b}	1.96^{a}	0.00^{b}
12.77^{a}	28.01^{a}	24.24^{a}	14.66^{a}	0.78^{a}	0.60^{a}
cr:7.05	cr:3.89	cr:1.96	cr:12.71	cr:1.56	cr:0.47

COMMON SUBSCRIPT DIFFER ($P<0.05$)
TEST

FIG. 4 CONTINUED

OMEGA-3 ENRICHED CHIA DIET FOR LAYING HENS

THE INFLUENCE OF CHIA ON EGG TASTE AND FLAVOR

TREATMENT	TASTE PREFERENCE[Y]	FLAVOR[Z]
0% CHIA	0.38 a[X]	2.00 a
30% CHIA	0.38 a	1.66 a
	cr[W]: 0.49	cr: 0.53

Z TASTE PREFERENCE SCORED USING:
0 - NO DIFFERENCE BETWEEN EGGS
1 - A PREFERENCE OF ONE EGG OVER THE OTHER

Y FLAVOR SCORED USING:
1 - NO OFF-FLAVOR
2 - MILD OFF-FLAVOR
3 - STRONG OFF-FLAVOR

X MEANS WITHIN A COLUMN LACKING A COMMON SUBSCRIPT DIFFER ($P < 0.05$) ACCORDING TO DUNCAN'S MULTIPLE RANGE TEST

W CRITICAL RANGE FOR MEAN SEPARATION

FIG. 5

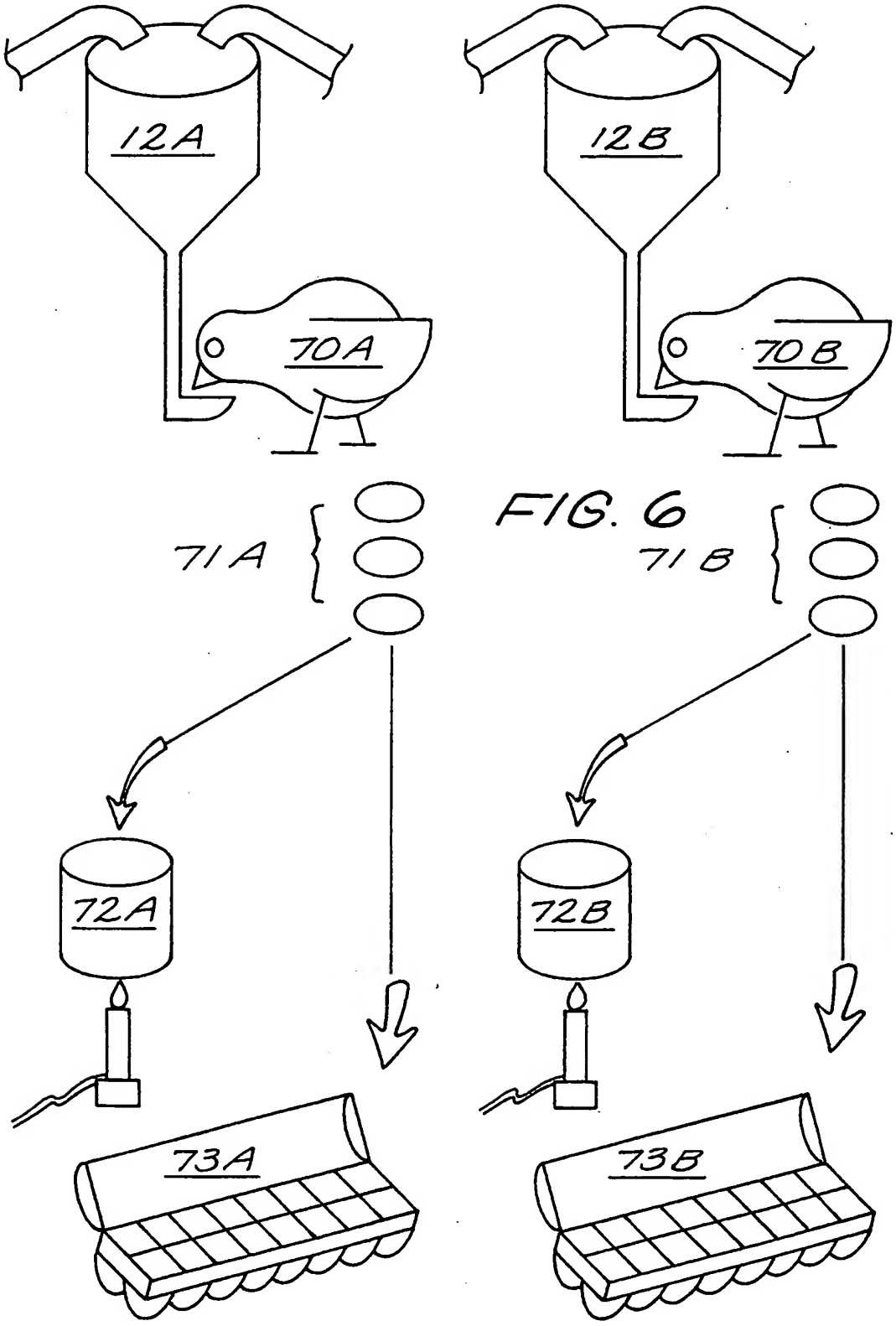

FIG. 6

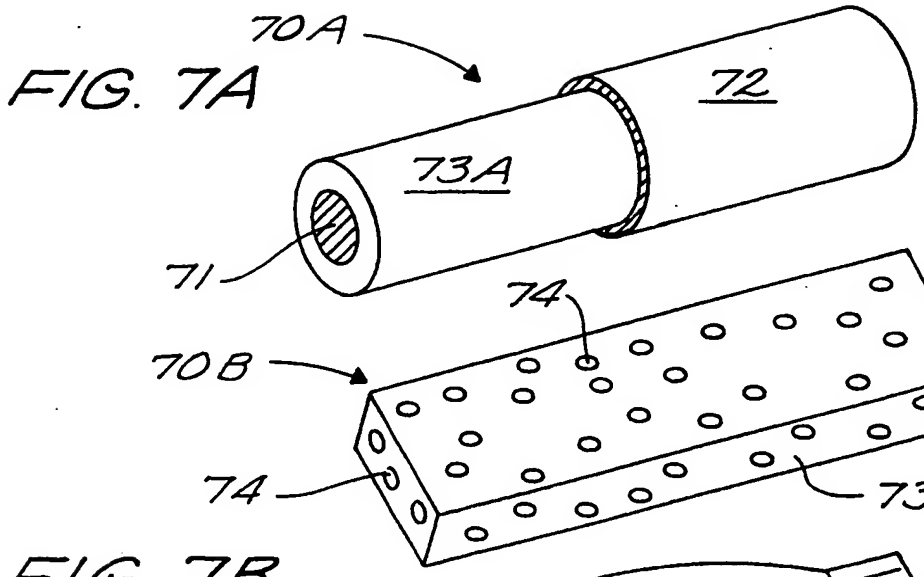

FIG. 7A

FIG. 7B

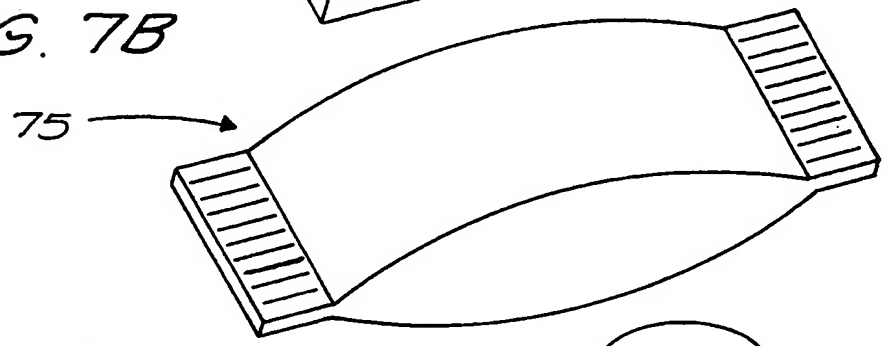

FIG. 7C

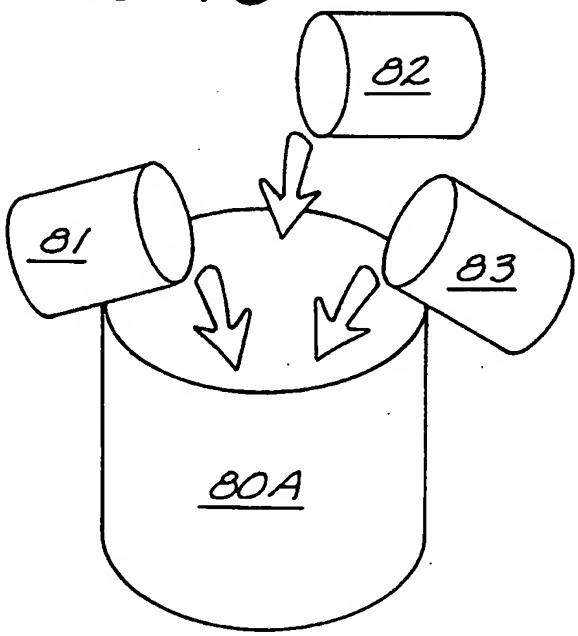

FIG. 8A

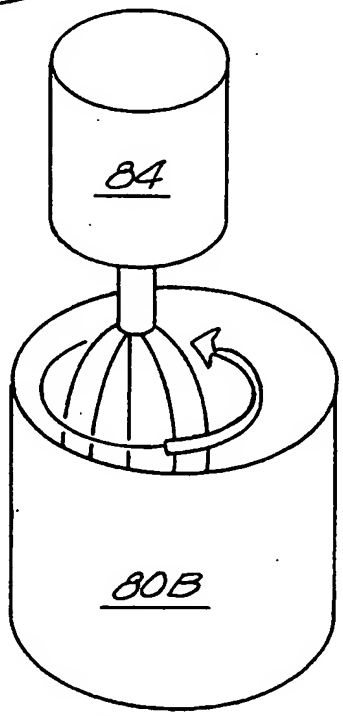

FIG. 8B

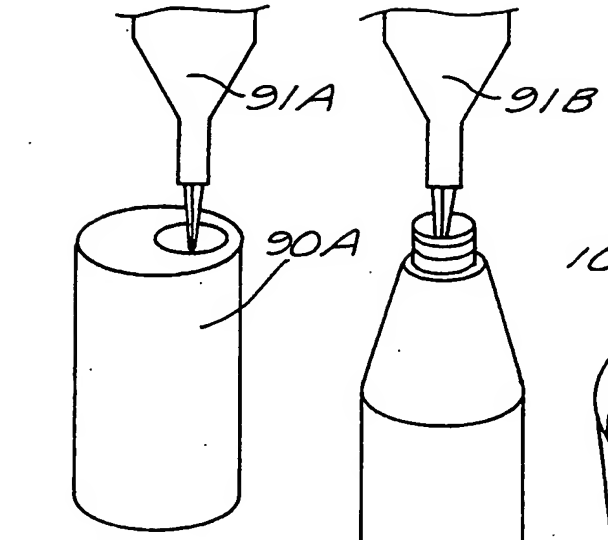

FIG. 9A

FIG. 9B

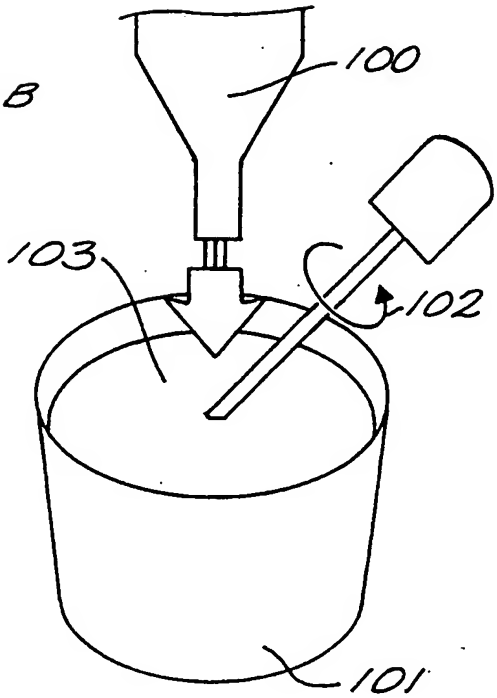

FIG. 10A

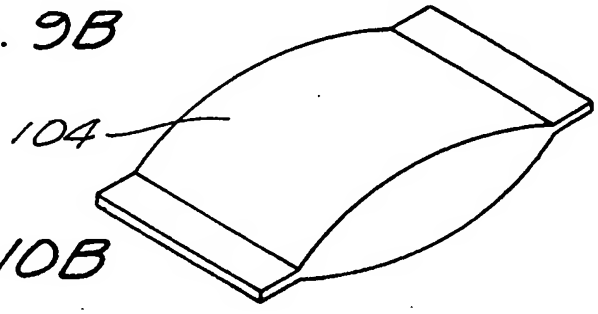

FIG. 10B

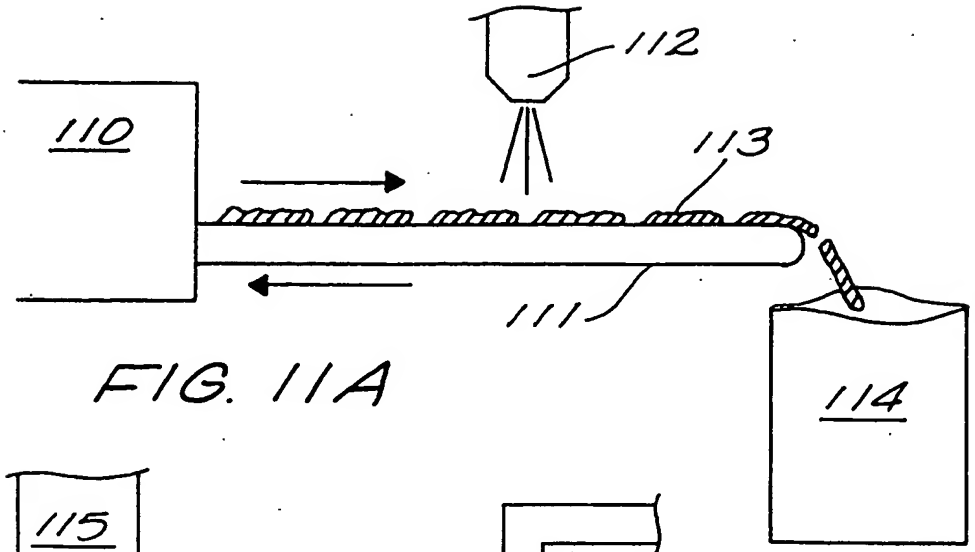

FIG. 11A

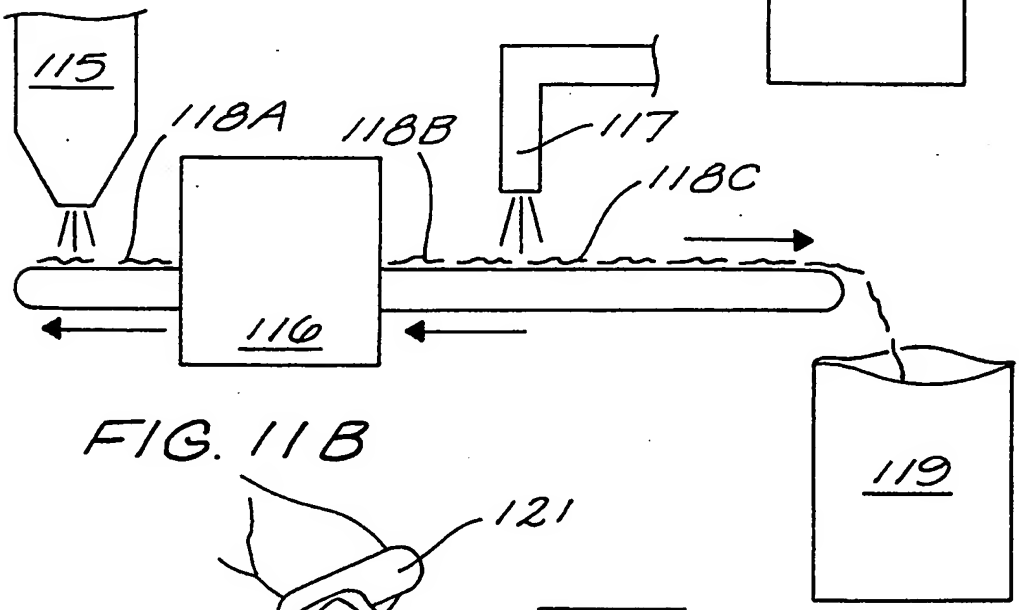

FIG. 11B

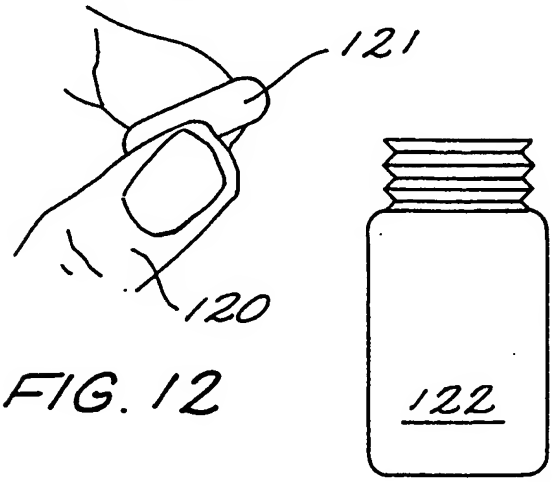

FIG. 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/12233

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : A23K 1/175, 1/00; A23L 1/30;
US CL : 426/72, 74, 623

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 426/72, 74, 623

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,612,074 A (LEACH) 18 March 1997, col. 1, lines 15-19.	1, 15-17, 19
Y	US 4,496,606 A (MICHNOWSKI) 29 January 1985, col. 7, lines 12-14.	2-7
Y	US 5,705,207 A (COOK et al) 06 January 1998, col. 20, lines 20-22.	8
Y	US 5,154,855 A (SEKIGUCHI et al) 13 October 1992, col. 9, lines 55-57.	9-13
Y	US 4,523,697 A (JEANS) 18 June 1985, col. 1, lines 12-16.	14
Y	US 4,900,566 A (HOWARD) 13 February 1990, col. 12, lines 10-14	18

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 16 JULY 1999	Date of mailing of the international search report 28 SEP 1999
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer PHILIP DUBOIS Telephone No. (703) 305-0508

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/12233

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,709,896 A (HARTIGAN et al) 20 January 1998, col. 1, lines 13-16.	20
Y	US 4,931,468 A (HORROBIN) 05 June 1990, col. 7, lines 3-5.	21-22
Y	US 4,961,932 A (THEEUWES) 09 October 1990, col. 12, lines 65-70.	21-22
Y,P	US 5,891,493 A (SANTILLO, JR.) 06 April 1999, col. 2, lines 5-25.	1-10
Y	US 5,656,312 A (ERASMUS et al) 12 August 1997, col. 1, lines 20-35.	11-18